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WASHINGTON, D.C. 20460

OFFICE OF
SOLID WASTE AND EMERGENCY RESP

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OSWER Directive 9835.8

MEMORANDUM

SUBJECT: Model Statement of Work for a Remedial Investigation and Feasibility Study Conducted by Potentially Responsible Parties

FROM: Bruce M. Diamond, Director
Office of Waste Programs Enforcement

TO: Director, Waste Management Division,
Regions I, IV, V, VII, and VIII
Director, Emergency and Remedial Response Division,
Region II
Director, Hazardous Waste Management Division,
Region III and VI
Director, Toxics and Waste Management Division,
Region IX
Director, Hazardous Waste Division,
Region X

Communities and individuals often express concern with the ability of potentially responsible parties (PRPs) to adequately perform remedial investigations and feasibility studies (RI/FSs) at Superfund sites. Some people believe that PRPs may conduct either an inadequate assessment of the nature and extent of contamination at a site, and/or an inadequate assessment of the risks posed by a site. In addition, Regional offices continue to express an interest in receiving guidance on how to better assure the quality of a PRP conducted RI/FS.

One step to be employed in improving the quality of a PRP-conducted RI/FS is the use of a more precise statement of work (SOW) during negotiations that include the results of preliminary scoping by EPA. This memorandum transmits a final model SOW designed to produce a PRP-conducted RI/FS that is consistent with the Office of Emergency and Remedial Response's Guidance for Conducting Remedial Investigations and Feasibility Studies, October 1988 (OSWER Directive 9355.3-01).

Additionally, the model SOW satisfies Regional views that interim deliverables are a necessary ingredient to advancing the prospects of a quality PRP-conducted RI/FS. Most of the interim deliverables covered under the model SOW are in the nature of technical memoranda that may or may not require EPA approval before the next step in the RI/FS is commenced by PRPs. Of course, EPA would be able to direct PRPs to undertake additional work if the interim deliverable is not satisfactory. In any event, discretion is provided to tailor the model SOW to the particular circumstances of the site or practices of the Regional office. The instructions to the model SOW provide further explanation on this subject, as well as on the subject of reserving portions of the RI/FS for conduct by EPA.

We have made every attempt to incorporate all relevant comments received from various Headquarters and Regional offices. As you proceed to use the model SOW, any questions or additional insights should be directed to Tony Diecidue of my staff at FTS (202)-382-4015.

Attachment

cc: CERCLA Enforcement Branch Chiefs, Regions I-X
CERCLA Enforcement Section Chiefs, Regions I-X
Regional Counsels, Regions I-X
Henry L. Longest
Glenn L. Unterberger

MODEL STATEMENT OF WORK FOR A REMEDIAL INVESTIGATION AND FEASIBILITY STUDY CONDUCTED BY POTENTIALLY RESPONSIBLE PARTIES

INSTRUCTIONS

This model statement of work (SOW) was developed to provide potentially responsible parties (PRPs) direction in performing the tasks that are required to successfully complete a remedial investigation/feasibility study (RI/FS). A SOW for a PRP-lead RI/FS must be used in conjunction with the Office of Emergency and Remedial Response's October 1988 Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (hereafter referred to as the RI/FS Guidance) and should be used with the Office of Waste Programs Enforcement's forthcoming Guidance on Oversight of Potentially Responsible Party Remedial Investigations and Feasibility Studies. The organization of this model SOW is according to the tasks that must be performed during a PRP-conducted RI/FS. These tasks include:

Task 1	Scoping;
Task 2	Community Relations;
Task 3	Site Characterization;
Task 4	Baseline Risk Assessment;
Task 5	Treatability Studies;
Task 6	Development & Screening of Remedial Alternatives;
Task 7	Detailed Analysis of Remedial Alternatives.

This model SOW is written on the general approach that a PRP RI/FS is commenced pursuant to an Administrative Order on Consent (AOC) with an attached SOW, and that the PRPs perform work and submit deliverables to EPA. Depending on site circumstances and the relationship to PRPs, it may be necessary to modify this management approach. Moreover, because the work required to perform a RI/FS is dependent on a site's complexity and the amount of available information, it may be necessary to modify the components of this model SOW in order to tailor the tasks to the specific conditions at a site. Similarly, the level of detail within the model SOW will vary according to the site. The Regions have discretion to develop a site-specific SOW that does not precisely follow this model SOW, including portions of the work to be performed by EPA, technical provisions, deliverables and approvals. An example of an alteration to this model SOW may include the PRPs' responsibilities concerning the baseline risk assessment. Because the baseline risk assessment serves as a primary means for supporting enforcement decisions at most sites, the Regions may write a site-specific SOW providing for EPA preparation of the risk assessment or the exposure assumptions. While not preferred as a general approach, at some sites EPA may develop itself, or in negotiations, a work plan rather than a SOW

and then enter into an AOC.

When special notice for a RI/FS is issued, at most sites a draft SOW should be attached as an addendum to a draft AOC. Prior to the issuance of special notice, EPA, generally with contractor assistance, will determine both the objectives of the RI/FS and a general approach for managing the site. Determining the site objectives and a general site strategy will be required regardless of whether an administrative order is signed with the PRPs or the RI/FS is Fund-financed.

The site objectives should specify the purpose of any activities to be conducted at the site, including any interim actions that may be necessary, as well as the objectives of the required remedial actions (e.g., the preliminary cleanup goals). These objectives should specify the contaminants and media of concern, the exposure pathways and receptors, and an acceptable contaminant level or range of levels for each exposure route. The site objectives are developed and based on existing site information, contaminant-specific ARARs, when available, and risk related factors.

The site management strategy is developed once the objectives have been established and identifies the study boundary areas and the optimal sequence of site activities, including whether the site may best be remedied as separate operable units. The general management approach should include: identifying the types of actions that may be required to address site problems, identifying any interim actions that are necessary to mitigate potential threats or prevent further environmental degradation, and determining the optimal sequence of activities to be conducted at the site. Also included in the site management strategy should be the decision as to whether the RI will serve as a continuation of the PRP search. This would be appropriate at sites such as areawide groundwater contamination or stream contamination where all of the sources of contamination are not yet well defined.

The deliverables described in this model SOW fall under one of three management categories. Under the first category, deliverables must be approved by EPA before work can either begin or continue. This includes the work plan and the site sampling and analysis plan. Similarly, EPA approval of the final risk assessment, RI report, treatability studies and FS is the general approach. Under the second category, EPA may exercise an option, in drafting the site-specific SOW, to either comment on or review and approve the deliverables. Review and approval of deliverables under this second category will be based on the particular circumstances of the site or practices of the Regional

office. This category will include most of the deliverables that are described in this model SOW, such as technical memoranda and reports. A middle ground is to allow work in these areas to proceed without resubmittal and approval so long as the changes required by EPA are fully reflected in subsequent deliverables. This approach of commenting strikes a balance between excessive approval and dispute resolution of numerous interim activities by PRPs, which cumulatively results in a lengthy RI/FS, and review at the end of the six major components of the RI/FS, which could result in months of unacceptable work not detected until late in the process. It also assures focus on the major deliverables. In addition, consistent with the RI/FS guidance, some work is simultaneously done. Under the third category, deliverables do not require comment from EPA. This category includes PRP progress reports. A summary of the major deliverables under categories one and two, as outlined in this model SOW, is included in the document.

Interim deliverables in addition to those required by the RI/FS Guidance are described in this model SOW. These deliverables are appropriate because of the different relationships and interactions between a Fund-lead and PRP-lead RI/FS. Review of these deliverables will help to assure EPA that the work being performed meets the terms and conditions of the AOC. Those deliverables other than what are required by the RI/FS Guidance that are described within this model SOW may not be necessary or appropriate for all sites. Similarly, deliverables other than what are described in this model SOW may be more appropriate for a particular site. The deliverables determined to be appropriate for a particular site should be approved by EPA management and must be specified in the AOC. The timing of the RI/FS and available oversight resources should be considered prior to determining the appropriate deliverables. Offices within the Region other than Superfund which will concur or comment on PRP deliverables should be consulted during the scoping process.

The Remedial Project Manager (RPM) should assure good communications with the PRPs. This includes meetings to discuss EPA's expectations before major phases of work are begun and to review the conclusions of major components of the RI/FS. In addition, the RPM should assure that EPA management is informed and has input on major components of the RI/FS. While this varies from site to site, management review usually is appropriate at scoping, final review of the work plan, before final comments are submitted on the RI, and as the FS is finally developed.

SUMMARY OF MAJOR DELIVERABLES[1]
(AS OUTLINED IN THIS MODEL SOW FOR PRP-CONDUCTED RI/FS)

TASK/DELIVERABLE		MANAGEMENT CATEGORY
TASK 1	**SCOPING**	
-	RI/FS Work Plan	(1) Review and Approve
-	Sampling and Analysis Plan (SAP)	(1) Review and Approve
-	Site Health and Saftey Plan	(2) Review and Comment
TASK 3	**SITE CHARACTERIZATION**	
-	Technical Memorandum on Modeling of Site Characteristics (where appropriate)	(2) Review and Approve
-	Preliminary Site Characterization Summary	(2) Review and Comment
-	Draft Remedial Investigation (RI) Report	(1) Review and Approve
TASK 4	**BASELINE RISK ASSESSMENT**	
-	Technical Memorandum Listing Hazardous Substances and Indicator Chemicals	(2) Review and Approve
-	Technical Memorandum Describing Exposure Scenarios and Fate and Transport Models	(2) Review and Approve
-	Technical Memorandum Listing Toxicological and Epidemiological Studies	(2) Review and Approve
-	Plan for Evaluating Environmental Risk	(2) Review and Approve

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[1] See the Model RI/FS Administrative Order on Consent (AOC) for additional reporting requirements, and further instructions on submittal and disposition of deliverables.

	- Environmental Evaluation Report (separate from or included in the Baseline Risk Assessment)	(2)	Review and Approve
	- Baseline Risk Assessment Chapter of the RI Report	(1)	Review and Approve
TASK 5	**TREATABILITY STUDIES**		
	- Technical Memorandum Identifying Candidate Technologies	(2)	Review and Approve
	- Treatability Testing Statement of Work	(2)	Review and Comment
	- Treatability Testing Work Plan (or amendment to original)	(1)	Review and Approve
	- Treatability Study SAP (or amendment to original)	(1)	Review and Approve
	- Treatability Study Site Health and Safety Plan (or amendment to original)	(2)	Review and Comment
	- Treatability Study Evaluation Report	(1)	Review and Approve
TASK 6	**DEVELOPMENT AND SCREENING OF REMEDIAL ALTERNATIVES**		
	- Technical Memorandum Documenting Revised Remedial Action Objectives	(2)	Review and Comment
	- Technical Memorandum on Remedial Technologies, Alternatives and Screening	(2)	Review and Comment
TASK 7	**DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES**		
	- Technical Memorandum Summarizing Results of Comparative Analysis of Alternatives	(2)	Review and Approve
	- Draft Feasibility Study (FS) Report	(1)	Review and Approve

MODEL STATEMENT OF WORK FOR PRP-CONDUCTED REMEDIAL INVESTIGATIONS AND FEASIBILITY STUDIES

INTRODUCTION

The purpose of this remedial investigation/feasibility study (RI/FS) is to investigate the nature and extent of contamination at a site, assess the potential risk to human health and the environment, and develop and evaluate potential remedial alternatives. The RI and FS are interactive and may be conducted concurrently so that the data collected in the RI influences the development of remedial alternatives in the FS, which in turn affects the data needs and the scope of treatability studies.

The respondent will conduct this RI/FS and will produce a draft RI and FS report that are in accordance with this statement of work, the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (U.S. EPA, Office of Emergency and Remedial Response, October 1988), and any other guidances that EPA uses in conducting a RI/FS (a list of the primary guidances is attached), as well as any additional requirements in the administrative order. The RI/FS Guidance describes the report format and the required report content. The respondent will furnish all necessary personnel, materials, and services needed, or incidental to, performing the RI/FS, except as otherwise specified in the administrative order.

At the completion of the RI/FS, EPA will be responsible for the selection of a site remedy and will document this selection in a Record of Decision (ROD). The remedial action alternative selected by EPA will meet the cleanup standards specified in CERCLA Section 121. That is, the selected remedial action will be protective of human health and the environment, will be in compliance with, or include a waiver of, applicable or relevant and appropriate requirements of other laws, will be cost-effective, will utilize permanent solutions and alternative treatment technologies or resource recovery technologies, to the maximum extent practicable, and will address the statutory preference for treatment as a principal element. The final RI/FS report, as adopted by EPA, will, with the administrative record, form the basis for the selection of the site's remedy and will provide the information necessary to support the development of the ROD.

As specified in CERCLA Section 104(a)(1), as amended by SARA, EPA will provide oversight of the respondent's activities throughout the RI/FS. The respondent will support EPA's initiation and conduct of activities related to the implementation of oversight activities.

TASK 1 - SCOPING (RI/FS Guidance, Chapter 2)

Scoping is the initial planning process of the RI/FS and is initiated by EPA prior to issuing special notice. During this time, the site-specific objectives of the RI/FS are determined by EPA. Scoping is therefore initiated prior to negotiations between the PRPs and EPA, and is continued, repeated as necessary, and refined throughout the RI/FS process. In addition to developing the site specific objectives of the RI/FS, EPA will determine a general management approach for the site. Consistent with the general management approach, the specific project scope will be planned by the respondent and EPA. The respondent will document the specific project scope in a work plan. Because the work required to perform a RI/FS is not fully known at the onset, and is phased in accordance with a site's complexity and the amount of available information, it may be necessary to modify the work plan during the RI/FS to satisfy the objectives of the study.

The site objectives for the _____ site located in the State of _____ have been determined preliminarily, based on available information, to be the following:

The strategy for the general management of the_____ _____ site will include the following:

When scoping the specific aspects of a project, the respondent must meet with EPA to discuss all project planning decisions and special concerns associated with the site. The following activities shall be performed by the respondent as a

function of the project planning process.

a. Site Background (2.2)

The respondent will gather and analyze the existing site background information and will conduct a site visit to assist in planning the scope of the RI/FS.

Collect and analyze existing data and document the need for additional data (2.2.2; 2.2.6; 2.2.7)

Before planning RI/FS activities, all existing site data will be thoroughly compiled and reviewed by the respondent. Specifically, this will include presently available data relating to the varieties and quantities of hazardous substances at the site, and past disposal practices. This will also include results from any previous sampling events that may have been conducted. The respondent will refer to Table 2-1 of the RI/FS Guidance for a comprehensive list of data collection information sources. This information will be utilized in determining additional data needed to characterize the site, better define potential applicable or relevant and appropriate requirements (ARARs), and develop a range of preliminarily identified remedial alternatives. data quality objectives (DQOs) will be established subject to EPA approval which specify the usefulness of existing data. Decisions on the necessary data and DQOs will be made by EPA.

Conduct Site Visit

The respondent will conduct a site visit during the project scoping phase to assist in developing a conceptual understanding of sources and areas of contamination as well as potential exposure pathways and receptors at the site. During the site visit the respondent should observe the site's physiography, hydrology, geology, and demographics, as well as natural resource, ecological and cultural features. This information will be utilized to better scope the project and to determine the extent of additional data necessary to characterize the site, better define potential ARARs, and narrow the range of preliminarily identified remedial alternatives.

b. Project Planning (2.2)

Once the respondent has collected and analyzed existing data and conducted a site visit, the specific project scope will be planned. Project planning activities include those tasks described below as well as identifying data needs, developing a

work plan, designing a data collection program, and identifying health and safety protocols. The respondent will meet with EPA regarding the following activities and before the drafting of the scoping deliverables below. These tasks are described in Section c. of this task since they result in the development of specific required deliverables.

Refine and document preliminary remedial action objectives and alternatives (2.2.3)

Once existing site information has been analyzed and a conceptual understanding of the potential site risks is reached, the respondent will review and, if necessary, refine the remedial action objectives that have been identified by EPA for each actually or potentially contaminated medium. The revised remedial action objectives will be documented in a technical memorandum and subject to EPA approval. The respondent will then identify a preliminary range of broadly defined potential remedial action alternatives and associated technologies. The range of potential alternatives should encompass where appropriate, alternatives in which treatment significantly reduces the toxicity, mobility, or volume of the waste; alternatives that involve containment with little or no treatment; and a no-action alternative.

Document the need for treatability studies (2.2.4)

If remedial actions involving treatment have been identified by the respondent or EPA, treatability studies will be required except where the respondent can demonstrate to EPA's satisfaction that they are not needed. Where treatability studies are needed, initial treatability testing activities (such as research and study design) will be planned to occur concurrently with site characterization activities (see Tasks 3 and 5).

Begin preliminary identification of Potential ARARs (2.2.5)

The respondent will conduct a preliminary identification of potential state and federal ARARs (chemical-specific, location-specific and action-specific) to assist in the refinement of remedial action objectives, and the initial identification of remedial alternatives and ARARs associated with particular actions. ARAR identification will continue as site conditions, contaminants, and remedial action alternatives are better defined.

c. Scoping Deliverables (2.3)

At the conclusion of the project planning phase, the respondent will submit a RI/FS work plan, a sampling and analysis plan, and a site health and safety plan. The RI/FS work plan and sampling and analysis plan must be reviewed and approved by EPA prior to the initiation of field activities.

RI/FS Work Plan (2.3.1)

A work plan documenting the decisions and evaluations completed during the scoping process will be submitted to EPA for review and approval. The work plan should be developed in conjunction with the sampling and analysis plan and the site health and safety plan, although each plan may be delivered under separate cover. The work plan will include a comprehensive description of the work to be performed, including the methodologies to be utilized, as well as a corresponding schedule for completion. In addition, the work plan must include the rationale for performing the required activities.

Specifically, the work plan will present a statement of the problem(s) and potential problem(s) posed by the site and the objectives of the RI/FS. Furthermore, the plan will include a site background summary setting forth the site description including the geographic location of the site, and to the extent possible, a description of the site's physiography, hydrology, geology, demographics, ecological, cultural and natural resource features; a synopsis of the site history and a description of previous responses that have been conducted at the site by local, state, federal, or private parties; a summary of the existing data in terms of physical and chemical characteristics of the contaminants identified, and their distribution among the environmental media at the site. The plan will also include a conceptual "model" describing the contaminant sources, and potential migration and exposure pathways and receptors. In addition, the plan will include a description of the site management strategy developed by EPA during scoping; a preliminary identification of remedial alternatives and data needs for evaluation of remedial alternatives. The plan will reflect coordination with treatability study requirements (see Tasks 1 and 5). It will include a process for and manner of identifying Federal and state ARARs (chemical-specific, location-specific and action-specific).

Finally, the major part of the work plan is a detailed description of the tasks to be performed, information needed for each task (e.g., for health and environmental risk

evaluation), information to be produced during and at the conclusion of each task, and a description of the work products that will be submitted to EPA. This includes the deliverables set forth in the remainder of this statement of work; a schedule for each of the required activities which is consistent with the RI/FS guidance; and a project management plan, including a data management plan (e.g., requirements for project mangement systems and software, minimum data requirements, data format and backup data management), monthly reports to EPA and meetings and presentations to EPA at the conclusion of each major phase of the RI/FS. The respondent will refer to Appendix B of the RI/FS Guidance for a comprehensive description of the contents of the required work plan.

Because of the unknown nature of the site and iterative nature of the RI/FS, additional data requirements and analyses may be identified throughout the process. The respondent will submit a technical memorandum documenting the need for additional data, and identifying the DQOs whenever such requirements are identified. In any event, the respondent is responsible for fulfilling additional data and analysis needs identified by EPA consistent with the general scope and objectives of this RI/FS.

Sampling and Analysis Plan (2.3.2)

The respondent will prepare a sampling and analysis plan (SAP) to ensure that sample collection and analytical activities are conducted in accordance with technically acceptable protocols and that the data meet DQOs. The SAP provides a mechanism for planning field activities and consists of a field sampling plan (FSP) and a quality assurance project plan (QAPP).

The FSP will define in detail the sampling and data-gathering methods that will be used on the project. It will include sampling objectives, sample location and frequency, sampling equipment and procedures, and sample handling and analysis. The QAPP will describe the project objectives and organization, functional activities, and quality assurance and quality control (QA/QC) protocols that will be used to achieve the desired DQOs. The DQOs will at a minimum reflect use of analytic methods to identifying contamination and remediating contamination consistent with the levels for remedial action objectives identified at 40 CFR Part 300, pages 51425-26 and 51433 (December 21, 1988). In addition, the QAPP will address sampling procedures, sample custody, analytical procedures, and data reduction, validation, reporting and personnel qualifications. Field personnel

should be available for EPA QA/QC training and orientation where applicable.

The respondent will demonstrate, in advance to EPA's satisfaction, that each laboratory it may use is qualified to conduct the proposed work. This includes use of methods and analytical protocols for the chemicals of concern in the media of interest within detection and quantification limits consistent with both QA/QC procedures and DQOs approved in the QAPP for the site by EPA. The laboratory must have and follow an approved QA program. If a laboratory not in the Contract Laboratory Program (CLP) is selected, methods consistent with CLP methods that would be used at this site for the purposes proposed and QA/QC procedures approved by EPA will be used. If the laboratory is not in the CLP program, a laboratory QA program must be submitted for EPA review and approval. EPA may require that the respondent submit detailed information to demonstrate that the laboratory is qualified to conduct the work, including information on personnel qualifications, equipment and material specifications. The respondent will provide assurances that EPA has access to laboratory personnel, equipment and records for sample collection, transportation and analysis.

Site Health and Safety Plan (2.3.3)

A health and safety plan will be prepared in conformance with the respondent's health and safety program, and in compliance with OSHA regulations and protocols. The health and safety plan will include the 11 elements described in the RI/FS Guidance, such as a health and safety risk analysis, a description of monitoring and personal protective equipment, medical monitoring, and site control. It should be noted that EPA does not "approve" the respondent's health and safety plan, but rather EPA reviews it to ensure that all necessary elements are included, and that the plan provides for the protection of human health and the environment.

TASK 2 - COMMUNITY RELATIONS

The development and implementation of community relations activities are the responsibility of EPA. The critical community relations planning steps performed by EPA include conducting community interviews and developing a community relations plan. Although implementation of the community relations plan is the responsibility of EPA, the respondent may assist by providing information regarding the site's history, participating in public meetings, or by preparing fact sheets for distribution to the

general public. In addition, the respondent may establish a community information repository, at or near the site, to house one copy of the administrative record. The extent of PRP involvement in community relations activities is left to the discretion of EPA. The respondents' community relations responsibilities, if any, are specified in the community relations plan. All PRP-conducted community relations activities will be subject to oversight by EPA.

TASK 3 - SITE CHARACTERIZATION (RI/FS Guidance, Chapter 3)

As part of the RI, the respondent will perform the activities described in this task, including the preparation of a site characterization summary and a RI report. The overall objective of site characterization is to describe areas of a site that may pose a threat to human health or the environment. This is accomplished by first determining a site's physiography, geology, and hydrology. Surface and subsurface pathways of migration will be defined. The respondent will identify the sources of contamination and define the nature, extent, and volume of the sources of contamination, including their physical and chemical constituents as well as their concentrations at incremental locations to background in the affected media. The respondent will also investigate the extent of migration of this contamination as well as its volume and any changes in its physical or chemical characteristics, to provide for a comprehensive understanding of the nature and extent of contamination at the site. Using this information, contaminant fate and transport is then determined and projected.

During this phase of the RI/FS, the work plan, SAP, and health and safety plan are implemented. Field data are collected and analyzed to provide the information required to accomplish the objectives of the study. The respondent will notify EPA at least two weeks in advance of the field work regarding the planned dates for field activities, including field lay out of the sampling grid, excavation, installation of wells, initiating sampling, installation and callibration of equipment, pump tests, and initiation of analysis and other field investigation activities. The respondent will demonstrate that the laboratory and type of laboratory analyses that will be utilized during site characterization meets the specific QA/QC requirements and the DQOs of the site investigation as specified in the SAP. In view of the unknown site conditions, activities are often iterative, and to satisfy the objectives of the RI/FS it may be necessary for the respondent to supplement the work specified in the initial work plan. In addition to the deliverables below, the respondent will provide a monthly progress report and participate in meetings at major points in the RI/FS.

a. Field Investigation (3.2)

The field investigation includes the gathering of data to define site physical characteristics, sources of contamination, and the nature and extent of contamination at the site. These activities will be performed by the respondent in accordance with the work plan and SAP. At a minimum, this shall address the following:

Implement and document field support activities (3.2.1)

The respondent will initiate field support activities following approval of the work plan and SAP. Field support activities may include obtaining access to the site, scheduling, and procuring equipment, office space, laboratory services, and/or contractors. The respondent will notify EPA at least two weeks prior to initiating field support activities so that EPA may adequately schedule oversight tasks. The respondent will also notify EPA in writing upon completion of field support activities.

Investigate and define site physical characteristics (3.2.2)

The respondent will collect data on the physical characteristics of the site and its surrounding areas including the physiography, geology, and hydrology, and specific physical characteristics identified in the work plan. This information will be ascertained through a combination of physical measurements, observations, and sampling efforts and will be utilized to define potential transport pathways and receptor populations. In defining the site's physical characteristics the respondent will also obtain sufficient engineering data (such as pumping characteristics) for the projection of contaminant fate and transport, and development and screening of remedial action alternatives, including information to assess treatment technologies.

Define sources of contamination (3.2.3)

The respondent will locate each source of contamination. For each location, the areal extent and depth of contamination will be determined by sampling at incremental depths on a sampling grid. The physical characteristics and chemical constituents and their concentrations will be determined for all known and discovered sources of contamination. The respondent shall conduct sufficient sampling to define the boundaries of the contaminant sources

to the level established in the QA/QC plan and DQOs. Defining the source of contamination will include analyzing the potential for contaminant release (e.g., long term leaching from soil), contaminant mobility and persistence, and characteristics important for evaluating remedial actions, including information to assess treatment technologies.

Describe the nature and extent of contamination (3.2.4)

The respondent will gather information to describe the nature and extent of contamination as a final step during the field investigation. To describe the nature and extent of contamination, the respondent will utilize the information on site physical characteristics and sources of contamination to give a preliminary estimate of the contaminants that may have migrated. The respondent will then implement an iterative monitoring program and any study program identified in the work plan or SAP such that by using analytical techniques sufficient to detect and quantify the concentration of contaminants, the migration of contaminants through the various media at the site can be determined. In addition, the respondent will gather data for calculations of contaminant fate and transport. This process is continued until the area and depth of contamination are known to the level of contamination established in the QA/QC plan and DQOs. Information on the nature and extent of contamination will be utilized to determine the level of risk presented by the site and will help to determine aspects of the appropriate remedial action alternatives to be evaluated.

b. Data Analyses (3.4)

Evaluate site characteristics (3.4.1)

The respondent will analyze and evaluate the data to describe: (1) site physical characteristics, (2) contaminant source characteristics, (3) nature and extent of contamination, and (4) contaminant fate and transport. Results of the site physical characteristics, source characteristics, and extent of contamination analyses are utilized in the analysis of contaminant fate and transport. The evaluation will include the actual and potential magnitude of releases from the sources, and horizontal and vertical spread of contamination as well as mobility and persistence of contaminants. Where modeling is appropriate, such models shall be identified to EPA in a technical memorandum prior to their use. All data and programming, including any proprietary programs, shall be made available

to EPA together with a sensitivity analysis. Also, this evaluation shall provide any information relevant to site characteristics necessary for evaluation of the need for remedial action in the risk assessment and for the development and evaluation of remedial alternatives. Analyses of data collected for site characterization will meet the DQOs developed in the QA/QC plan stated in the SAP (or revised during the RI).

c. Data Management Procedures (3.5)

The respondent will consistently document the quality and validity of field and laboratory data compiled during the RI.

Document field activities (3.5.1)

Information gathered during site characterization will be consistently documented and adequately recorded by the respondent in well maintained field logs and laboratory reports. The method(s) of documentation must be specified in the work plan and/or the SAP. Field logs must be utilized to document observations, measurements, and significant events that have occurred during field activities. Laboratory reports must document sample custody, analytical responsibility, analytical results, adherence to prescribed protocols, nonconformity events, corrective measures, and/or data deficiencies.

Maintain sample management and tracking (3.5.2; 3.5.3)

The respondent will maintain field reports, sample shipment records, analytical results, and QA/QC reports to ensure that only validated analytical data are reported and utilized in the development and evaluation of remedial alternatives. Analytical results developed under the work plan will not be included in any site characterization reports unless accompanied by or cross-referenced to a corresponding QA/QC report. In addition, the respondent will establish a data security system to safeguard chain-of-custody forms and other project records to prevent loss, damage, or alteration of project documentation.

d. Site Characterization Deliverables (3.7)

The respondent will prepare the preliminary site characterization summary and, once the baseline risk assessment (Task 4) is complete, the remedial investigation report.

Preliminary Site Characterization Summary (3.7.2)

After completing field sampling and analysis, the respondent will prepare a concise site characterization summary. This summary will review the investigative activities that have taken place; describe and display site data documenting the location and characteristics of surface and subsurface features and contamination at the site including the affected medium location, types, physical state, concentration of contaminants and quantity. In addition, the location, dimensions, physical condition and varying concentrations of each contaminant throughout each source and the extent of contaminant migration through each of the affected media will be documented. The site characterization summary will provide EPA with a preliminary reference for developing the risk assessment, and evaluating the development and screening of remedial alternatives and the refinement and identification of ARARs.

Remedial Investigation (RI) Report (3.7.3)

The respondent will prepare and submit a draft RI report to EPA for review and approval after completion of the baseline risk assessment (see Task 4). This report shall summarize results of field activities to characterize the site, sources of contamination, nature and extent of contamination, the fate and transport of contaminants, and results of the baseline risk assessment. The respondent will refer to the RI/FS Guidance for an outline of the report format and contents. Following comment by EPA, the respondent will prepare a final RI report which satisfactorily addresses EPA's comments.

TASK 4 - BASELINE RISK ASSESSMENT (3.4.2)

A baseline risk assessment will identify and characterize the toxicity and levels of hazardous substances present, contaminant fate and transport, the potential for human or environmental exposure, or both, and the risk of potential impacts or threats on human health and the environment. It will provide the basis for determining whether or not remedial action is necessary, and a justification for performing remedial actions. The procedures to perform a baseline risk assessment for human health are outlined in EPA's Superfund Public Health Evaluation Manual (SPHEM). These procedures are outlined below and must be followed by the respondent. Other resources that the respondent must utilize when performing the baseline risk assessment include: EPA's Superfund Exposure Assessment Manual (SEAM), the Integrated Risk Information System (IRIS), the Public Health Risk Evaluation Database (PHRED), and the Interim Final

Risk Assessment Guidance for Superfund - Environmental Evaluation Manual.

a. Human Health and Risk Assessment Components

The risk assessment process is divided into the four components listed below. During the scoping of the risk assessment, the respondent will discuss with EPA the format of the risk assessment report as well as the references to be utilized during the baseline risk assessment.

Contaminant identification and documentation

The respondent will review the information that is available on the hazardous substances present at the site and will identify the contaminants of concern. The indicator chemicals, or contaminants of concern, are not chosen solely on the basis of chemical-specific ARARs. Rather, they are selected based on quantity, the concentration of contaminants on site as compared to levels that pose a risk, or critical exposure pathways, such as drinking water. When selecting the indicator chemicals, the respondent must also consider the additive effect of risks. The respondent shall submit to EPA for review and approval a technical memorandum listing the hazardous substances present at the site and the indicator chemicals with the known corresponding ambient concentrations of these contaminants. Chemical-specific ARARs should also be identified at this time.

Exposure assessment and documentation

Using the information in the SEAM, the respondent will identify actual and potential exposure points and pathways. Exposure assumptions must be supported with validated data and must be consistent with Agency policy. Validation of data that has not previously undergone Agency review may be performed as long as it does not delay the RI/FS schedule. For each exposure point, the release source, the transport media (e.g., ground water, surface water, air) and the exposure route (oral, inhalation, dermal) must be clearly delineated. The current number of people at each exposure point must be estimated and, both sensitive and potentially exposed populations must be characterized. Both present and future risks at the site must be considered, and both current and maximum reasonable use scenarios must be considered. The respondent will submit to EPA for review and approval a technical memorandum describing the exposure scenarios with a description of the assumptions made and the use of data. In addition, the respondent will submit to EPA for review and approval a description of the fate and

transport models that will be utilized, including a summary of the data that will be used with these models. Representative data must be utilized and the limitations and uncertainties with the models must be documented.

Toxicity assessment and documentation

The respondent will utilize the information in IRIS to provide a toxicity assessment of the indicator chemicals. This assessment will include the types of adverse health and/or environmental effects associated with chemical exposures (including potential carcinogenicity), the relationships between magnitude of exposures and adverse effects, and the related uncertainties for contaminant toxicity (e.g., the weight of evidence for a chemical's carcinogenicity). For those substances lacking an EPA toxicity value for which the respondent wishes to develop its own toxicity value, the respondent will submit to EPA for review and approval a technical memorandum listing the toxicological and epidemiological studies that will be utilized to perform the toxicity assessment. All data utilized in the toxicity assessment must be validated and have gone through EPA review. Validation of data that has not previously undergone Agency review may be performed as long as it does not delay the RI/FS schedule.

Risk characterization

The respondent will integrate the ambient concentrations and reasonable worst case assumptions with the information developed during the exposure and toxicity assessments, to characterize the current and potential risk to human health and the environment posed by the site. This risk characterization must identify any uncertainties associated with contaminants, toxicities, and/or exposure assumptions.

b. Baseline Risk Assessment Deliverables

The respondent is required to prepare the technical memoranda listed in Item a of Task 4 of this SOW. The final risk assessment report is submitted at the completion of site characterization with the draft RI report (see Task 3).

Baseline Risk Assessment Chapter of the RI Report

The baseline risk assessment report will be submitted to EPA for review and approval. The report will include a comprehensive description of the four components of the risk assessment and will follow the principles established in the SPHEM. A discussion of sources of uncertainty, data gaps,

incomplete toxicity information, and modeling characteristics must be included. The respondent will refer to the SPHEM for an outline of the report format.

c. Environmental Evaluation and Deliverables

In addition to the human health risk assessment, the risks to the environment from exposure to the contaminants must be addressed.

Environmental Evaluation Plan

The respondent will submit for EPA's review and approval a plan for the evaluation of the environmental risk. This plan must specify the objectives of the evaluation and the information necessary to adequately characterize the nature and extent of environmental risk or threat resulting from the site. At a minimum, this plan must demonstrate how the environmental evaluation will address: (1) any critical habitats affected by site contamination; and (2) any endangered species or habitats of endangered species affected by the contamination. The respondent will utilize the Interim Final Risk Assessment Guidance for Superfund - Environmental Evaluation Manual.

Environmental Evaluation Report

The environmental evaluation report will be submitted to EPA for review and approval. This evaluation may be included in the baseline risk assessment report or as a document separate from the human health risk assessment. At a minimum, the environmental evaluation report will include an assessment of any critical habitats, and any endangered species or habitats of endangered species affected by the contamination at the site.

TASK 5 - TREATABILITY STUDIES (RI/FS Manual, Chapter 5)

Treatability testing will be performed by the respondent to assist in the detailed analysis of alternatives. In addition, if applicable, testing results and operating conditions will be used in the detailed design of the selected remedial technology. The following activities will be performed by the respondent.

a. Determination of Candidate Technologies and of the Need for Testing (5.2; 5.4)

The respondent will identify in a technical memorandum, subject to EPA review and approval, candidate technologies for a treatability studies program during project planning (Task 1).

The listing of candidate technologies will cover the range of technologies required for alternatives analysis (Task 6 a.) The specific data requirements for the testing program will be determined and refined during site characterization and the development and screening of remedial alternatives (Tasks 2 and 6, respectively).

Conduct literature survey and determine the need for treatability testing (5.2)

The respondent will conduct a literature survey to gather information on performance, relative costs, applicability, removal efficiencies, operation and maintenance (O&M) requirements, and implementability of candidate technologies. If practical candidate technologies have not been sufficiently demonstrated, or cannot be adequately evaluated for this site on the basis of available information, treatability testing will be conducted. Where it is determined by EPA that treatability testing is required, and unless the respondent can demonstrate to EPA's satisfaction that they are not needed, the respondent will submit a statement of work to EPA outlining the steps and data necessary to evaluate and initiate the treatability testing program.

Evaluate treatability studies (5.4)

Once a decision has been made to perform treatability studies, the respondent and EPA will decide on the type of treatability testing to use (e.g., bench versus pilot). Because of the time required to design, fabricate, and install pilot scale equipment as well as perform testing for various operating conditions, the decision to perform pilot testing should be made as early in the process as possible to minimize potential delays of the FS. To assure that a treatability testing program is completed on time, and with accurate results, the respondent will either submit a separate treatability testing work plan or an amendment to the original site work plan for EPA review and approval.

b. Treatability Testing and Deliverables (5.5; 5.6; 5.8)

The deliverables that are required, in addition to the memorandum identifying candidate technologies, where treatability testing is conducted include a work plan, a sampling and analysis plan, and a final treatability evaluation report. EPA may also require a treatability study health and safety plan, where appropriate.

Treatability testing work plan (5.5)

The respondent will prepare a treatability testing work plan or amendment to the orignal site work plan for EPA review and approval describing the site background, remedial technology(ies) to be tested, test objectives, experimental procedures, treatability conditions to be tested, measurements of performance, analytical methods, data management and analysis, health and safety, and residual waste management. The DQOs for treatability testing should be documented as well. If pilot-scale treatability testing is to be performed, the pilot-scale work plan will describe pilot plant installation and start-up, pilot plant operation and maintenance procedures, operating conditions to be tested, a sampling plan to determine pilot plant performance, and a detailed health and safety plan. If testing is to be performed off-site, permitting requirements will be addressed.

Treatability study SAP (5.5)

If the original QAPP or FSP is not adequate for defining the activities to be performed during the treatability tests, a separate treatability study SAP or amendment to the original site SAP will be prepared by the respondent for EPA review and approval. Task 1, Item c. of this statement of work provides additional information on the requirements of the SAP.

Treatability study health and safety plan (5.5)

If the original health and safety plan is not adequate for defining the activities to be performed during the treatment tests, a separate or amended health and safety plan will be developed by the respondent. Task 1, Item c. of this statement of work provides additional information on the requirements of the health and safety plan. EPA does not "approve" the treatability study health and safety plan.

Treatability study evaluation report (5.6)

Following completion of treatability testing, the respondent will analyze and interpret the testing results in a technical report to EPA. Depending on the sequence of activities, this report may be a part of the RI/FS report or a separate deliverable. The report will evaluate each technology's effectiveness, implementability, cost and actual results as compared with predicted results. The report will also evaluate full-scale application of the technology, including a sensitivity analysis identifying the

key parameters affecting full-scale operation.

TASK 6 - DEVELOPMENT AND SCREENING OF REMEDIAL ALTERNATIVES (RI/FS Manual, Chapter 4)

The development and screening of remedial alternatives is performed to develop an appropriate range of waste management options that will be evaluated. This range of alternatives should include as appropriate, options in which treatment is used to reduce the toxicity, mobility, or volume of wastes, but varying in the types of treatment, the amount treated, and the manner in which long-term residuals or untreated wastes are managed; options involving containment with little or no treatment; options involving both treatment and containment; and a no-action alternative. The following activities will be performed by the respondent as a function of the development and screening of remedial alternatives.

a. Development and Screening of Remedial Alternatives (4.2)

The respondent will begin to develop and evaluate a range of appropriate waste management options that at a minimum ensure protection of human health and the environment, concurrent with the RI site characterization task.

Refine and document remedial action objectives (4.2.1)

The respondent will review and if necessary propose refinement to the site-specific remedial action objectives that were established by EPA prior to negotiations between EPA and the respondent. The revised remedial action objectives will be documented in a technical memorandum. These objectives will specify the contaminants and media of interest, exposure pathways and receptors, and an acceptable contaminant level or range of levels for each exposure route.

Develop general response actions (4.2.2)

The respondent will develop general response actions for each medium of interest defining containment, treatment, excavation, pumping, or other actions, singly or in combination, to satisfy the remedial action objectives.

Identify areas or volumes of media (4.2.3)

The respondent will identify areas or volumes of media to which general response actions may apply, taking into account requirements for protectiveness as identified in the remedial action objectives. The chemical and physical

characterization of the site will also be taken into account.

Identify, screen, and document remedial technologies (4.2.4; 4.2.5)

The respondent will identify and evaluate technologies applicable to each general response action to eliminate those that cannot be implemented at the site. General response actions will be refined to specify remedial technology types. Technology process options for each of the technology types will be identified either concurrent with the identification of technology types, or following the screening of the considered technology types. Process options will be evaluated on the basis of effectiveness, implementability, and cost factors to select and retain one or, if necessary, more representative process for each technology type. The technology types and process options will be summarized for inclusion in a technical memorandum. The reasons for eliminating alternatives must be specified.

Assemble and document alternatives (4.2.6)

The respondent will assemble selected representative technologies into alternatives for each affected medium or operable unit. Together, all of the alternatives will represent a range of treatment and containment combinations that will address either the site or the operable unit as a whole. A summary of the assembled alternatives and their related action-specific ARARs will be prepared by the respondent for inclusion in a technical memorandum. The reasons for eliminating alternatives during the preliminary screening process must be specified.

Refine alternatives

The respondent will refine the remedial alternatives to identify contaminant volume addressed by the proposed process and sizing of critical unit operations as necessary. Sufficient information will be collected for an adequate comparison of alternatives. Remedial action objectives for each medium will also be refined as necessary to incorporate any new risk assessment information being generated from the remedial investigation. Additionally, action-specific ARARs will be updated as the remedial alternatives are refined.

Conduct and document screening evaluation of each alternative (4.3)

The respondent may perform a final screening process based

on short and long term aspects of effectiveness, implementability, and relative cost. Generally, this screening process is only necessary when there are many feasible alternatives available for detailed analysis. If necessary, the screening of alternatives will be conducted to assure that only the alternatives with the most favorable composite evaluation of all factors are retained for further analysis.

As appropriate, the screening will preserve the range of treatment and containment alternatives that was initially developed. The range of remaining alternatives will include options that use treatment technologies and permanent solutions to the maximum extent practicable. The respondent will prepare a technical memorandum summarizing the results and reasoning employed in screening, arraying alternatives that remain after screening, and identifying the action-specific ARARs for the alternatives that remain after screening.

b. Alternatives Development and Screening Deliverables (4.5)

The respondent will prepare a technical memorandum summarizing the work performed in and the results of each task above, including an alternatives array summary. These will be modified by the respondent if required by EPA's comments to assure identification of a complete and appropriate range of viable alternatives to be considered in the detailed analysis. This deliverable will document the methods, rationale, and results of the alternatives screening process.

TASK 7 - DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES (RI/FS Guidance, Chapter 6)

The detailed analysis will be conducted by the respondent to provide EPA with the information needed to allow for the selection of a site remedy. This analysis is the final task to be performed by the respondent during the FS.

a. Detailed Analysis of Alternatives (6.2)

The respondent will conduct a detailed analysis of alternatives which will consist of an analysis of each option against a set of nine evaluation criteria and a comparative analysis of all options using the same evaluation criteria as a basis for comparison.

Apply nine criteria and document analysis (6.2.1 - 6.2.4)

The respondent will apply nine evaluation criteria to the

assembled remedial alternatives to ensure that the selected remedial alternative will be protective of human health and the environment; will be in compliance with, or include a waiver of, ARARs; will be cost-effective; will utilize permanent solutions and alternative treatment technologies, or resource recovery technologies, to the maximum extent practicable; and will address the statuory preference for treatment as a principal element. The evaluation criteria include: (1) overall protection of human health and the environment; (2) compliance with ARARs; (3) long-term effectiveness and permanence; (4) reduction of toxicity, mobility, or volume; (5) short-term effectiveness; (6) implementability; (7) cost; (8) state (or support agency) acceptance; and (9) community acceptance. (Note: criteria 8 and 9 are considered after the RI/FS report has been released to the general public.) For each alternative, the respondent should provide: (1) a description of the alternative that outlines the waste management strategy involved and identifies the key ARARs associated with each alternative, and (2) a discussion of the individual criterion assessment. If the respondent does not have direct input on criteria (8) state (or support agency) acceptance and (9) community acceptance, these will be addressed by EPA.

Compare alternatives against each other and document the comparison of alternatives (6.2.5; 6.2.6)

The respondent will perform a comparative analysis between the remedial alternatives. That is, each alternative will be compared against the others using the evaluation criteria as a basis of comparison. Identification and selection of the preferred alternative are reserved by EPA. The respondent will prepare a technical memorandum summarizing the results of the comparative analysis.

b. Detailed Analysis Deliverables (6.5)

In addition to the technical memorandum summarizing the results of the comparative analysis, the respondent will submit a draft FS report to EPA for review and approval. Once EPA's comments have been addressed by the respondent to EPA's satisfaction, the final FS report may be bound with the final RI report.

Feasibility study report (6.5)

The respondent will prepare a draft FS report for EPA review and comment. This report, as ultimately adopted or amended by EPA, provides a basis for remedy selection by EPA and

documents the development and analysis of remedial alternatives. The respondent will refer to the RI/FS Guidance for an outline of the report format and the required report content. The respondent will prepare a final FS report which satisfactorily addresses EPA's comments.

REFERENCES FOR CITATION

The following list, although not comprehensive, comprises many of the regulations and guidance documents that apply to the RI/FS process:

The (revised) National Contingency Plan

"Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA," U.S. EPA, Office of Emergency and Remedial Response, October 1988, OSWER Directive No. 9355.3-01.

"Interim Guidance on Potentially Responsible Party Participation in Remedial Investigation and Feasibility Studies," U.S. EPA, Office of Waste Programs Enforcement, Appendix A to OSWER Directive No. 9355.3-01.

"Guidance on Oversight of Potentially Responsible Party Remedial Investigations and Feasibility Studies," U.S. EPA, Office of Waste Programs Enforcement, (forthcoming), OSWER Directive No. 9835.3.

"A Compendium of Superfund Field Operations Methods," Two Volumes, U.S. EPA, Office of Emergency and Remedial Response, EPA/540/P-87/001a, August 1987, OSWER Directive No. 9355.0-14.

"EPA NEIC Policies and Procedures Manua," May 1978, revised November 1984, EPA-330/9-78-001-R.

"Data Quality Objectives for Remedial Response Activities," U.S. EPA, Office of Emergency and Remedial Response and Office of Waste Programs Enforcement, EPA/540/G-87/003, March 1987, OSWER Directive No. 9335.0-7B.

"Guidelines and Specifications for Preparing Quality Assurance Project Plans," U.S. EPA, Office of Research and Development, Cincinnati, OH, QAMS-004/80, December 29, 1980.

"Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans," U.S. EPA, Office of Emergency and Remedial Response, QAMS-005/80, December 1980.

"Users Guide to the EPA Contract Laboratory Program," U.S. EPA, Sample Management Office, August 1982.

"Interim Guidance on Compliance with Applicable or Relevant and Appropriate Requirements," U.S. EPA, Office of Emergency and Remedial Response, July 9, 1987, OSWER Directive No. 9234.0-05.

"CERCLA Compliance with Other Laws Manual," Two Volumes, U.S. EPA, Office of Emergency and Remedial Response, August 1988 (draft), OSWER Directive No. 9234.1-01 and -02.

"Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites," U.S. EPA, Office of Emergency and Remedial Response, (draft), OSWER Directive No. 9283.1-2.

"Draft Guidance on Preparing Superfund Decision Documents," U.S. EPA, Office of Emergency and Remedial Response, March 1988, OSWER Directive No. 9355.3-02

"Superfund Public Health Evaluation Manual," U.S. EPA, Office of Emergency and Remedial Response, EPA/540/1-86/060, October 1986, OSWER Directive No. 9285.4-1.

"Superfund Exposure Assessment Manual," U.S. EPA, Office of Emergency and Remedial Response, September 22, 1987, OSWER Directive No. 9285.5-1.

"Interim Final Risk Assessment Guidance for Superfund - Environmental Evaluation Manual," U.S. EPA, Office of Emergency and Remedial Response, March 1989, OSWER Directive No. 9285.7-01.

"Health and Safety Requirements of Employees Employed in Field Activities," U.S. EPA, Office of Emergency and Remedial Response, July 12, 1981, EPA Order No. 1440.2.

OSHA Regulations in 29 CFR 1910.120 (Federal Register 45654, December 19, 1986).

"Interim Guidance on Administrative Records for Selection of CERCLA Response Actions," U.S. EPA, Office of Waste Programs Enforcement, March 1, 1989, OSWER Directive No. 9833.3A.

"Community Relations in Superfund: A Handbook," U.S. EPA, Office of Emergency and Remedial Response, June 1988, OSWER Directive No. 9230.0-3B.

"Community Relations During Enforcement Activities And Development of the Administrative Record," U.S. EPA, Office of Waste Programs Enforcement, November 1988, OSWER Directive No. 9836.0-1A.